PERFORMANCE ELECTRONICS, Ltd.
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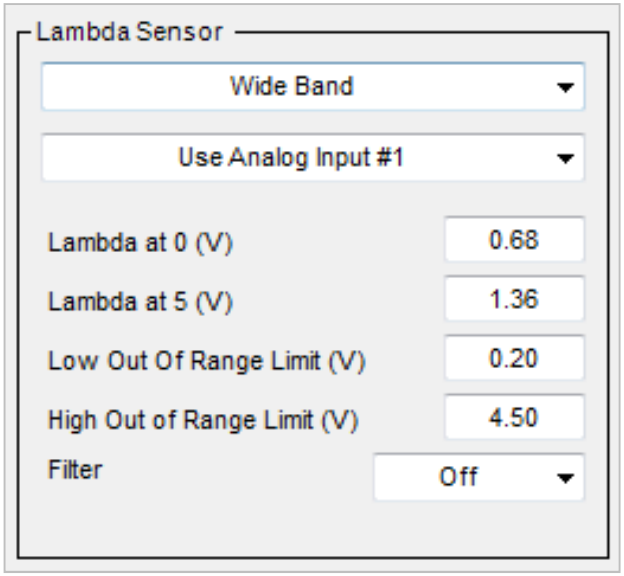
Programmable Fuel and Ignition Control Systems

AN103 – Application Note
PE Wide-Band Lambda Sensor Installation and Configuration
Release Date 1/30/13

Summary:	The PE Wide-Band Sensor Interface is a dual channel lambda measuring system designed to be used in conjunction with a Performance Electronics engine controller. The system has two 0-5 volt analog lambda outputs. The system uses low cost Bosch LSU 4.2 5-wire wide-band oxygen sensors.
Applications:	The wide band kit can be used with any PE engine controller that supports closed loop fuel control. The wide band kit can be used with gasoline and alcohol fueled engines. It can also be used with 2-stroke applications, however, sensor life will be severely limited.

Sensor Configuration Details	
Supply Voltage:	+12 volt, Switched Battery
Standard Calibration: (See figure to right)	Lambda at 0 (V) = 0.68 Lambda at 5 (V) = 1.36
Connectivity:	See Figure

Typical Sensor Setup in peMonitor



---------- CAUTION ----------

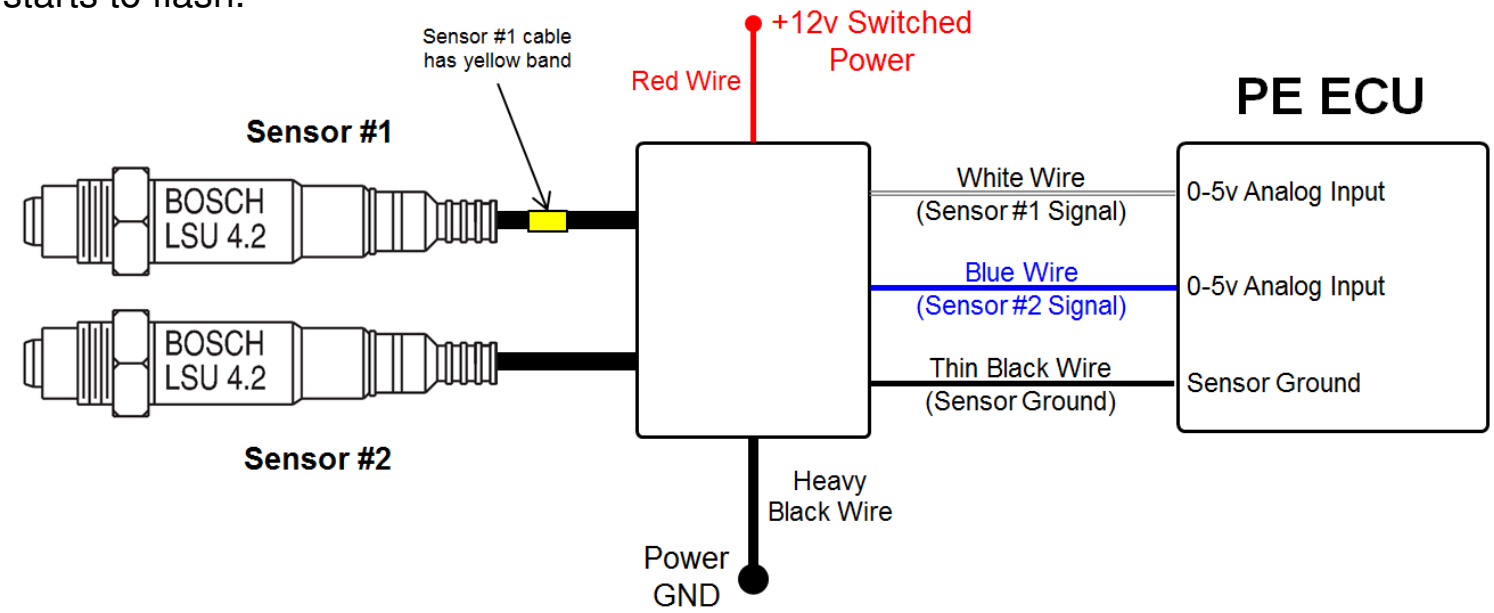
- Racing gasoline containing lead will quickly degrade wide band sensors. Under these conditions, expected sensor life is less than 10 hours.
- Using the PE Wide-Band with a 2-stroke engine will also quickly degrade the sensors.
- There is **NO** warranty on the Bosch sensors.

Installation and Setup

1. For best operation, the Bosch LSU 4.2 sensors should be located in the header pipe about 6-8 inches from the exhaust port or directly after the collector. Ideally, the sensor tip should face down to avoid accumulation of condensation. When choosing a mounting location, allow several inches clearance for the sensor wires. The wire harness must exit straight out from the sensor.
2. 18x1.5 mm weld nuts must be welded into the exhaust pipe. After welding, run a tap through the threads. Do not install the sensors until after the free-air calibration procedure described in the following section is complete. Always use an anti-seize lubricant such as Permatex 133A on the sensor threads.
3. Install the PE Wide-Band unit. The unit is fully sealed, but should be mounted away from sources of engine or exhaust heat. The unit can be secured by means of two #8 screws through the mounting flanges. Use nylon tie wraps to secure the wire harness near the unit.
4. Connect the Bosch sensors to the 6 pin mating connectors on the PE Wide-Band wire harness. The cable for sensor 1 exits at the top of the housing and is identified with a yellow band.
5. Refer to the figure on the next page for wiring. Before making any electrical connections to the PE Wide-Band, disconnect the negative battery cable of the vehicle. Connect the heavier black wire to a good chassis ground location. Connect the thin black wire to the sensor ground pin of the PE ECU. Keep the ground connections as short as possible.
6. If the vehicle uses any type of CD (capacitive discharge) ignition such as the MSD 6, 7, or 8 series, excessive noise on the wide band signal may be present without proper grounding and filtering of the ignition unit. Excessive noise can be reduced by directly connecting the CD ignition system to the battery terminals or by using a filter capacitor such as MSD P/N 8830.

Installation and Setup (continued)

7. Connect the red PE Wide-Band wire to switched +12 volt power.
8. Connect the sensor signal lines from the PE Wide-Band unit to the PE engine controller. These should be wired to appropriate 0-5v analog inputs on the ECU. Analog inputs can be configured in the peMonitor tuning software for lambda (see page 1 for example).
9. Reconnect the ground cable of the vehicle to the battery.
10. After installation, the PE Wide-Band requires free-air calibration. This should be done with the sensors dangling in free air. The environment must be free of hydrocarbon vapors. With the sensor in free air, turn the sensor calibration trim-pots on the PE Wide-Band full counterclockwise. Turn on power and wait for 60 seconds so the system can fully stabilize. Slowly turn each free air calibration trim-pot clockwise until the corresponding LED starts flashing at a rapid rate. Set each trim-pot at the point where its LED just starts to flash.



Operation

- The PE Wide-Band has status LEDs for each channel. When power is turned on, the LEDs blink at a slow rate until the corresponding sensor has reached normal operating temperature.
- The free air calibration procedure should be performed at reasonable intervals (every 250-500 hours if using unleaded gas or every 2-5 hours if using leaded racing gas) or whenever a sensor is replaced. If an LED will not flash when its trim-pot is turned full clockwise, the sensor is damaged or there is a very high hydrocarbon level in the environment.
- The PE Wide-Band includes internal diagnostics for abnormal battery voltage (less than 11 volts or greater than 16.5 volts), sensor open circuit, and sensor short circuit conditions. Any fault condition causes the status LEDs to blink at the slow rate.
- The PE Wide-Band system may give inaccurate results in certain situations:
    - **Misfiring** – If the fuel mixture is so rich that the engine misfires, high levels of oxygen will remain in the exhaust gas and result in an erroneous lean indication.
    - **Exhaust reversion –** Reversion is the term for a negative pressure wave that can suck ambient air back into the exhaust and cause an erroneous lean AFR indication. Open “drag pipes” usually suffer from reversion effects and may not be suitable for use with lambda control except at or near wide open throttle. Reversion effects will be most noticeable at idle, part throttle low RPM, and decel. Reversion is also very noticeable on single and two cylinder engines with short exhaust.
    - **Excessive exhaust back pressure –** Wide-band sensors are affected by back pressure. Excessive back pressure causes exaggerated AFR indications under rich and lean conditions, but has little effect at λ=1 (stoichiometric).
    - **Excessive scavenging –** Tuned exhausts in combination with a high overlap camshaft profile can pull unburned air and fuel mixture through the cylinder into the exhaust and cause an erroneous AFR indication. The same effect can occur with high boost turbo/supercharger applications.